

CLAIMS

1. An ink jet printing method of performing printing by repeating a scanning step for scanning a row of ink ejection
5 orifices for ejecting ink and a row of reacting liquid ejection orifices for ejecting a reacting liquid that reacts with the ink, across a printing medium, in order to eject the ink and the reacting liquid onto the printing medium, and a feeding step for feeding the printing medium,

10 wherein said scanning step performs the scan of the row of ink ejection orifices and the row of reacting liquid ejection orifices, so that a scanning area of the ink to which the ink is ejected while the row of ink ejection orifices scans and a scanning area of the reacting liquid to which
15 the reacting liquid is ejected while the row of reacting liquid ejection orifices scans are adjacent to each other in a feeding direction of the printing medium, and, among the ink and the reacting liquid that have different permeability, a width of the scanning area of a liquid having relatively high
20 permeability along the feeding direction is made longer than that of the scanning area of a liquid having relatively low permeability, or a width of the scanning area of a liquid having relatively high permeability along the feeding
25 direction is made equal to that of the scanning area of a liquid having relatively low permeability,

said feeding step feeds the printing medium, by an amount

corresponding to a width which is shorter than said width of the scanning area of the liquid having relatively high permeability by a predetermined amount, and in a direction so that the liquid having relatively high permeability is
5 ejected over the liquid having relatively low permeability, and

at least for the liquid having relatively high permeability, ejection of said liquid onto a first scanning area, which corresponds to a width of the predetermined amount
10 within the scanning area of said liquid, is performed during two times of scan, and ejection of said liquid onto a second scanning area other than said first scanning area, within the scanning area of said liquid, is performed during a single scan.

15 2. An ink jet printing method of performing printing by repeating a scanning step for scanning a row of ink ejection orifices for ejecting ink having a predetermined permeability and a row of reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the
20 predetermined permeability of the ink and reacts with the ink, across a printing medium, in order to eject the ink and the reacting liquid onto the printing medium, and a feeding step for feeding the printing medium,

wherein said scanning step performs the scan of the row
25 of ink ejection orifices and the row of reacting liquid ejection orifices, so that a scanning area of the ink ejection

orifices to which the ink is ejected while the row of ink
ejection orifices scans and a scanning area of the reacting
liquid ejection orifices to which the reacting liquid is
ejected while the row of reacting liquid ejection orifices
5 scans are adjacent to each other in a feeding direction of
the printing medium, and a width of the scanning area of the
reacting liquid ejection orifices along the feeding direction
is made shorter than that of the scanning area of the ink
ejection orifices by a predetermined amount,

10 said feeding step feeds the printing medium by an amount
corresponding to the width of the scanning area of the reacting
liquid ejection orifices,

the row of reacting liquid ejection orifices is located
at an upstream side of the row of ink ejection orifices
15 in the feeding direction so that the scanning area of the
ink ejection orifices and the scanning area of the reacting
liquid ejection orifices are made adjacent to each other in
the feeding direction in the same scan, and

ejection of the ink onto a first scanning area, which
20 corresponds to a width of the predetermined amount within
the scanning area of the ink ejection orifices, is performed
during two times of scan, and ejection of the ink onto a second
scanning area other than said first scanning area, within
the scanning area of the ink ejection orifices, is performed
25 during a single scan.

3. An ink jet printing method comprising:

a providing step for providing a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n-a) reacting liquid ejection orifices for ejecting a reacting liquid that has
5 lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices;

a scanning step for scanning the printing head in a different direction from the array direction across a printing
10 medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n-a) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan; and

15 a feeding step for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between successive two scanning by said scanning step,

wherein ejection of the reacting liquid onto the scanning
20 area of the reacting liquid ejection orifices is performed during a single scan, and

within the scanning area of the ink ejection orifices, ejection of the ink onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices
25 and which are located at respective end portions of the row of ink ejection orifices, is performed during two times of

scan, and ejection of the ink onto a scanning area, which has a width corresponding to $(n-a)$ ejection orifices and is not located at the end portion, is performed during a single scan.

5 4. An ink jet printing method comprising:

 a providing step for providing a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of $(n-a)$ reacting liquid ejection orifices for ejecting a reacting liquid that has
10 lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices;

 a scanning step for scanning the printing head in a different direction from the array direction across a printing
15 medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the $(n-a)$ orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan; and

20 a feeding step for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the $(n-a)$ ejection orifices, between successive two scanning by said scanning step,

 wherein, during a single scan by said scanning step,
25 ejection of the reacting liquid onto the scanning area of the reacting liquid ejection orifices is performed at a

printability duty of 100%, and

within the scanning area of the ink ejection orifices, ejection of the ink onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices and which are located at respective end portions of the row of ink ejection orifices, is performed at the printability duty of less than 100%, and ejection of the ink onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed at the printability duty of 100%.

5. An ink jet printing method of performing printing by repeating a scanning step for scanning a row of ink ejection orifices for ejecting ink having a predetermined permeability and a row of reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink, across a printing medium, in order to eject the ink and the reacting liquid onto the printing medium, and a feeding step for feeding the printing medium,

wherein said scanning step performs the scan of the row of ink ejection orifices and the row of reacting liquid ejection orifices, so that a scanning area of the ink ejection orifices to which the ink is ejected while the row of ink ejection orifices scans and a scanning area of the reacting liquid ejection orifices to which the reacting liquid is ejected while the row of reacting liquid ejection orifices

scans are adjacent to each other in a feeding direction of the printing medium, and a width of the scanning area of the reacting liquid ejection orifices along the feeding direction is made equal to that of the scanning area of the ink ejection orifices,

said feeding step feeds the printing medium by an amount corresponding to a width, which is shorter than the respective widths of the scanning areas of the ink ejection orifices and the reacting liquid ejection orifices by a predetermined amount,

the row of reacting liquid ejection orifices is located at a upstream side of the row of ink ejection orifices in the feeding direction so that the scanning area of the ink ejection orifices and the scanning area of the reacting liquid ejection orifices are made adjacent to each other in the feeding direction in the same scan, and

ejection of the ink and the reacting liquid onto a first scanning area, which corresponds to a width of the predetermined amount within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices, is performed during two times of scan, and ejection of the ink and the reacting liquid onto a second scanning area other than said first scanning area, within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices, is performed during a single scan.

6. An ink jet printing method comprising:

a providing step for providing a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n) reacting liquid ejection orifices for ejecting a reacting liquid that has
5 lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices;

a scanning step for relatively scanning the printing head in a different direction from the array direction across a
10 printing medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan;
15 and

a feeding step for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between successive two scanning by said scanning step,

20 wherein, within the scanning area of the ink ejection orifices and the reacting liquid ejection orifices, ejection of the ink and the reacting liquid onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices and which are located at respective end portions
25 of the respective rows of ink and reacting liquid ejection orifices, is performed during two times of scan, and ejection

of the ink and the reacting liquid onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed during a single scan.

5 7. An ink jet printing method comprising:

 a providing step for providing a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n) reacting liquid ejection orifices for ejecting a reacting liquid that has
10 lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices;

 a scanning step for relatively scanning the printing head in a different direction from the array direction across a
15 printing medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan;
20 and

 a feeding step for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between successive two scanning by said scanning step,

25 wherein, within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices,

ejection of the ink and the reacting liquid onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices and which are located at respective end portions of the row of ink and reacting liquid ejection orifices, is performed at the printability duty of less than 100%, and ejection of the ink and the reacting liquid onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed at the printability duty of 100%.

8. An ink jet printing method as claimed in claim 1, wherein the row of ink ejection orifices includes (n) ejection orifices and the row of reacting liquid ejection orifices includes (n-a) ejection orifices.

9. An ink jet printing method as claimed in claim 1, wherein the row of ink ejection orifices and the row of reacting liquid ejection orifices include (n) ejection orifices respectively, and said feeding step feeds the printing medium by an amount of $(n-a) \times p$ (here, p denotes a pitch of the (n) ejection orifices).

10. An ink jet printing method as claimed in claim 1, wherein the row of ink ejection orifices and the row of reacting liquid ejection orifices are employed in a manner that the row of ink ejection orifices and the row of reacting liquid ejection orifices are adjacent to each other in the feeding direction.

11. An ink jet printing method as claimed in claim 1,

wherein the ink or the reacting liquid is ejected during preceding scan by said scanning step in which the row of ink ejection orifices and the row of reacting liquid ejection orifices are subjected to a forward scan, then said feeding
5 step feeds the printing medium, and then the ink or the reacting liquid is ejected during after scan by said scanning step in which the row of ink ejection orifices and the row of reacting liquid ejection orifices are subjected to a backward scan.

12. An ink jet printing apparatus comprising scanning
10 means for scanning a row of ink ejection orifices for ejecting ink and a row of reacting liquid ejection orifices for ejecting a reacting liquid that reacts with the ink, across a printing medium, in order to eject the ink and the reacting liquid onto the printing medium, and feeding means for feeding the
15 printing medium, and repeating the scanning and the feeding to perform printing,

wherein said scanning means performs the scan of the row of ink ejection orifices and the row of reacting liquid ejection orifices, so that a scanning area of the ink to which
20 the ink is ejected while the row of ink ejection orifices scans and a scanning area of the reacting liquid to which the reacting liquid is ejected while the row of reacting liquid ejection orifices scans are adjacent to each other in a feeding direction of the printing medium, and, among the ink and the
25 reacting liquid that have different permeability, a width of the scanning area of a liquid having relatively high

permeability along the feeding direction is made longer than that of the scanning area of a liquid having relatively low permeability, or a width of the scanning area of a liquid having relatively high permeability along the feeding
5 direction is made equal to that of the scanning area of a liquid having relatively low permeability,

said feeding means feeds the printing medium, by an amount corresponding to a width which is shorter than said width of the scanning area of the liquid having relatively high
10 permeability by a predetermined amount, and in a direction so that the liquid having relatively high permeability is ejected over the liquid having relatively low permeability, and

at least for the liquid having relatively high
15 permeability, ejection of said liquid onto a first scanning area, which corresponds to a width of the predetermined amount within the scanning area of said liquid, is performed during two times of scan, and ejection of said liquid onto a second scanning area other than said first scanning area, within
20 the scanning area of said liquid, is performed during a single scan.

13. An ink jet printing apparatus comprising scanning means for scanning a row of ink ejection orifices for ejecting ink having a predetermined permeability and a row of reacting
25 liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability

of the ink and reacts with the ink, across a printing medium,
in order to eject the ink and the reacting liquid onto the
printing medium, and feeding means for feeding the printing
medium, and repeating the scanning and the feeding to perform
5 printing,

wherein said scanning means performs the scan of the row
of ink ejection orifices and the row of reacting liquid
ejection orifices, so that a scanning area of the ink ejection
orifices to which the ink is ejected while the row of ink
10 ejection orifices scans and a scanning area of the reacting
liquid ejection orifices to which the reacting liquid is
ejected while the row of reacting liquid ejection orifices
scans are adjacent to each other in a feeding direction of
the printing medium, and a width of the scanning area of the
15 reacting liquid ejection orifices along the feeding direction
is made shorter than that of the scanning area of the ink
ejection orifices by a predetermined amount,

said feeding means feeds the printing medium by an amount
corresponding to the width of the scanning area of the reacting
20 liquid ejection orifices,

the row of reacting liquid ejection orifices is located
at an upstream side of the row of ink ejection orifices in
the feeding direction so that the scanning area of the ink
ejection orifices and the scanning area of the reacting liquid
25 ejection orifices are made adjacent to each other in the
feeding direction in the same scan, and

ejection of the ink onto a first scanning area, which corresponds to a width of the predetermined amount within the scanning area of the ink ejection orifices, is performed during two times of scan, and ejection of the ink onto a second scanning area other than said first scanning area, within the scanning area of the ink ejection orifices, is performed during a single scan.

14. An ink jet printing apparatus using a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n-a) reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices and ejects the ink and the reacting liquid onto a printing medium, to perform printing, said apparatus comprising:

scanning means for scanning the printing head in a different direction from the array direction across a printing medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n-a) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan; and

feeding means for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between

successive two scanning by said scanning means,

wherein ejection of the reacting liquid onto the scanning area of the reacting liquid ejection orifices is performed during a single scan, and

5 within the scanning area of the ink ejection orifices, ejection of the ink onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices and which are located at respective end portions of the row of ink ejection orifices, is performed during two times of
10 scan, and ejection of the ink onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed during a single scan.

15 15. An ink jet printing apparatus using a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n-a) reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent
20 to each other in an array direction of the orifices and ejects the ink and the reacting liquid onto a printing medium, to perform printing, said apparatus comprising:

scanning means for scanning the printing head in a different direction from the array direction across a printing
25 medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n-a) orifices,

and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan; and

feeding, means for feeding the printing medium in a
5 direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between successive two scanning by said scanning means,

wherein, during a single scan by said scanning step, ejection of the reacting liquid onto the scanning area of
10 the reacting liquid ejection orifices is performed at a printability duty of 100%, and

within the scanning area of the ink ejection orifices, ejection of the ink onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices
15 and which are located at respective end portions of the row of ink ejection orifices, is performed at the printability duty of less than 100%, and ejection of the ink onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed
20 at the printability duty of 100%.

16. An ink jet printing apparatus comprising scanning means for scanning a row of ink ejection orifices for ejecting ink having a predetermined permeability and a row of reacting liquid ejection orifices for ejecting a reacting liquid that
25 has lower permeability than the predetermined permeability of the ink and reacts with the ink, across a printing medium,

in order to eject the ink and the reacting liquid onto the printing medium, and feeding means for feeding the printing medium and repeating the scanning and the feeding to perform printing,

5 wherein said scanning, means performs the scan of the row of ink ejection orifices and the row of reacting liquid ejection orifices, so that a scanning area of the ink ejection orifices to which the ink is ejected while the row of ink ejection orifices scans and a scanning area of the reacting
10 liquid ejection orifices to which the reacting liquid is ejected while the row of reacting liquid ejection orifices scans are adjacent to each other in a feeding direction of the printing medium, and a width of the scanning area of the reacting liquid ejection orifices along the feeding direction
15 is made equal to that of the scanning area of the ink ejection orifices,

 said feeding means feeds the printing medium by an amount corresponding to a width, which is shorter than the respective widths of the scanning areas of the ink ejection orifices
20 and the reacting liquid ejection orifices by a predetermined amount,

 the row of reacting liquid ejection orifices is located at an upstream side of the row of ink ejection orifices in the feeding direction so that the scanning area of the ink
25 ejection orifices and the scanning area of the reacting liquid ejection orifices are made adjacent to each other in the

feeding direction in the same scan, and

ejection of the ink and the reacting liquid onto a first scanning area, which corresponds to a width of the predetermined amount within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices, is performed during two times of scan, and ejection of the ink and the reacting liquid onto a second scanning area other than said first scanning area, within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices, is performed during a single scan.

17. An ink jet printing apparatus using a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n) reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices and ejects the ink and the reacting liquid onto a printing medium, to perform printing, said apparatus comprising:

scanning means for relatively scanning the printing head in a different direction from the array direction across a printing medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan;

and

feeding means for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between
5 successive two scanning by said scanning means,

wherein, within the scanning area of the ink ejection orifices and the reacting liquid ejection orifices, ejection of the ink and the reacting liquid onto the respective scanning areas, each of which has a width corresponding to (a) ejection
10 orifices and which are located at respective end portions of the respective rows of ink and reacting liquid ejection orifices, is performed during two times of scan, and ejection of the ink and the reacting liquid onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is
15 not located at the end portion, is performed during a single scan.

18. An ink jet printing apparatus using a printing head in which a row of (n) ink ejection orifices for ejecting ink having a predetermined permeability and a row of (n) reacting
20 liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink are arranged to be adjacent to each other in an array direction of the orifices and ejects the ink and the reacting liquid onto a printing medium, to
25 perform printing, said apparatus comprising:

scanning means for relatively scanning the printing head

in a different direction from the array direction across a printing medium so that a scanning area of the reacting liquid ejection orifices, which has a width corresponding to the (n) orifices, and a scanning area of the ink ejection orifices, which has a width corresponding to the (n) ink ejection orifices are adjacent to each other during a single scan; and

feeding means for feeding the printing medium in a direction perpendicular to the direction of scanning by a width corresponding to the (n-a) ejection orifices, between successive two scanning by said scanning means,

wherein, within the respective scanning areas of the ink ejection orifices and the reacting liquid ejection orifices, ejection of the ink and the reacting liquid onto the respective scanning areas, each of which has a width corresponding to (a) ejection orifices and which are located at respective end portions of the row of ink and reacting liquid ejection orifices, is performed at the printability duty of less than 100%, and ejection of the ink and the reacting liquid onto a scanning area, which has a width corresponding to (n-a) ejection orifices and is not located at the end portion, is performed at the printability duty of 100%.

19. A printing head comprising an ink ejection orifice row arranging a plurality of ink ejection orifices for ejecting ink having a predetermined permeability in a predetermined direction and a reacting liquid ejection row arranging a

plurality of reacting liquid ejection orifices for ejecting a reacting liquid that has lower permeability than the predetermined permeability of the ink and reacts with the ink,

5 wherein said ink ejection orifice row and said reacting liquid ejection row are arranged to be adjacent to each other, and

 the number of orifices in said reacting liquid ejection row is less than the number of orifices in said ink ejection
10 row.